

"A ROOF WATERPROOFING SYSTEM CONSISTING OF AN ORGANIC RESIN PROTECTED BY AN ALUMINUM-COPOLYMER COMPOSITE FOIL ".

The present Utility Model is related to a technique for protection of exposed building roofs, consisted of cementitious (or not) substrate, against percolation of water, that conjugates, in one system, two processes that confer watertightness to the roof, providing larger reliability to the surfaces against the percolation of water.

At present, the factory-prepared systems which are destined to obtain roof watertightness (except the conventional roofs in clay tile, fiber-cement or metallic elements) are mainly constituted of prefabricated asphalt-based, asphalt-elastomeric or pure elastomeric impermeable films.

The factory-prepared asphalt-based and asphalt-elastomeric sheets have usually an internal reinforcement provided by polyethylene films, non-woven polyester or non-woven fiberglass. Elastomeric films, particularly the fluid-applied elastomers, do not usually contain reinforcement in its interior, although some polymeric manufactured sheets do it to provide added strength and puncture resistance. These films are applied on a structural substrate (e.g. concrete slabs), sometimes regularized by cementitious mortar. The mortar is used to create a surface free from angular points and depressions besides granting suitable slope for water flow.

Some of these materials are applied to the mud slab through previous application of an appropriate asphalt-based primer, used to fix the films strongly to the substrate. Primer is cold-applied, but film attachment to the primer is executed, often times, through hot-process, by means of a torch.

In order to protect the film against the deleterious effect of ultraviolet rays, some roofing materials show, in one of their faces, an element in order to impede such effect

on the asphalt-based material. Usually, this element comprises an appropriate elastomer (Patent at USPTO under number 4,775,567: "A waterproofing laminate suitable for use in roofs, floors, or other surfaces where waterproofing is desired, comprises an elastomeric sheet secured to a modified bitumen layer and a release sheet secured to the modified  
5 bitumen layer. Certain preferred materials for use in the laminate are recited."), crushed slate powder, or thin aluminum film facing, surfacing one side of the asphalt-based sheet.

These prefabricated sheets are meant for roofs with eventual or sporadic traffic, usually necessary for maintenance or cleaning operations. Such facing materials do not give mechanical protection to the sheets, but they do protect them against the  
10 incidence of ultraviolet solar rays. On the other hand, infrared rays are also reflected by the aluminum facing, improving thermal comfort conditions on the environment protected by the referred sheets.

There are, still, factory-prepared asphalt-elastomeric membranes, in which one face presents self-adhesive finish and the other face receives, as in the previous case,  
15 a thin film facing of aluminum. (Patent at USPTO under numbers 4,936,938; 5,096,759 and 5,142,837 – "A laminated roofing material includes an aluminum foil top sheet laminated to a polyethylene film by an ionomer resin. After the sheets are bonded together they are cooled to set the resin and an asphalt (bitumen) coating is applied to the exposed polyethylene sheet and covered with a release paper. The roofing material  
20 is applied over an underlayment to form a roof supported by conventional sheeting material.")

Such a material has several applications in the building construction sector, as for example, the recovery of metallic roofs which present leakage caused by oxidation and consequent perforation of the roof metallic cover. In this case, primers are not

used, as one of the material faces already has an adhesive element, provided that the substrate is absolutely clean and dry to promote attachment.

The main disadvantage in the case of the aluminum-faced membranes resides in the low mechanical resistance of the coating on the exposed face. As the aluminum film is  
5 extremely thin (about 35 to 50 micrometers), it is subject to the damaging mechanical actions which may expose the asphalt-based portion of the membrane to the ultraviolet solar rays.

Another quite common occurrence in the usage of asphalt-based or elastomeric sheets to building construction roofs is the difficulty to locate eventual defects that could lead to watertightness failure. The infiltration can be caused by a flaw in lateral or  
10 longitudinal welding of the membrane strip overlaps or even by involuntary perforation in the sheet. Water penetrates through the flaw, reaches the mud slab and percolates the interior of its porous matrix under the roofing membrane, till it finds a defect in the cimentitious substrate (e.g. a joint, a "bug hole"), making the leakage visible on the inside of the building. Most of the time, the point at which the leakage becomes visible  
15 does not coincide with the position of the failure which caused the leak. Moreover, as primer attaches the sheet firmly to the deck, in case a dynamic crack appears in the substrate due to structural movements (e.g. severe climatic thermal gradients), the new joint will probably propagate to the roofing material, splitting it at this position and allowing water to enter the split.

20 With the objective of solving such inconveniences, the present system was developed, through which substrate watertightness is assured by two processes: first, an organic, flexible, hydrophobic, self-leveling and viscoelastic composition resin is applied directly on the structural substrate to be treated, sealing the pores in its surface; second, an impermeable aluminum foil laminated with thermoplastic  
25 copolymers is adhered to the surface by the organic resin.

The advantages of this system when compared to the existing ones are as follows: a) it offers relatively large resistance to involuntary mechanical injuries on the foil, due to the presence of larger film thickness (about 300 micrometers); b) its watertightness results from two different processes: in the hypothesis that a severe mechanical injury causes foil perforation, the structure will stay tight as its pores remain sealed by the organic resin action; c) the fact that the system permits being applied directly over the concrete deck structure, eliminating the need of previous execution of mud slab, which is indispensable in the prevalent waterproofing systems, and leading to greater economic feasibility; d) the system can also be applied over mud slab substrates, although direct application on concrete deck structure is preferable; e) the ease and economy in the location of the leak-causing flaw, when flood test is in progress, if the proposed system is applied directly on the concrete deck structure; and, f) the resin, being viscoelastic, allows reasonable adherence of the film composite to the substrate, admitting the possibility of small sliding between them; this characteristic is the one responsible for the integrity of the film in the circumstance of a dynamic crack arise on the deck, as such crack is not transmitted to the film, since it slides on the resin layer without breaking, differently from asphaltic or asphalt-elastomeric sheets which are intimately stuck to the substrate by means of primers.

The invention can be better understood through the following detailed description, in consonance with the drawing enclosed, where:

ILLUSTRATION 1 shows the plan of a surface on which the proposed system was applied.

ILLUSTRATION 2 shows the longitudinal section of a surface on which the proposed system was applied.

**BEST AVAILABLE COPY**

ILLUSTRATION 3 shows the traverse section of a surface on which the proposed system was applied.

With regard to these illustrations, it can be observed that the organic resin (4) is applied over the deck structure (1) and its baseboards or parapets (2). This resin (4) has high attachment power to porous and non-porous substrates, besides having self-leveling, hydrophobic and viscoelastic characteristics; in the specific case of the porous substrates, the material sticks to the surface, penetrating the external capillaries of the porous matrix and sealing them. Therefore, this material turns the porous surface totally impervious to water and, as the resin is highly flexible, it allows deck's small structural movements without loosing watertightness.

Over the substrate, previously treated with the mentioned resin, a composite film (5) of aluminum laminated on both faces with thermoplastic copolymers is applied in a way so as to protect the resin against the harmful action of ultraviolet solar light. The welding (7) of the several strips of the composite, in the longitudinal direction, is done by the application of heated air, through appropriate equipment and temperature, in the overlap interface of two adjacent strips. The copolymer which laminates the aluminum foil is thermoplastic and allows to be melted with heated air, attaching the adjacent sheets on the overlapping strip. No bonding materials are needed for this purpose.

For better fastening of the composite strip edges to the deck, screws are used (6), endowed with plastic washers, attached in common expansion shells that are introduced inside appropriate holes, performed in the structure of the baseboards and parapets (2).

The rain water, collected on the treated surface, flows through a pipeline (3) in PVC or other material destined for that purpose.

**BEST AVAILABLE COPY**